

was to be an almost daily witness of its inconceivable cruelties, and to feel himself powerless to help. Even in this matter, however, we believe his words and example will have had a good moral effect on many of the native chiefs, if not on the degraded dealers; for the people are so demoralised by the latter, that they hunt and sell each other. This Arab slave-hunting was a great hindrance to Livingstone's progress, as the dealers had so terrified the people as to make them suspicious of every stranger, and, with one or two creditable exceptions, did all in their power to poison the native mind against the white man, for they knew that he regarded their doings with unmitigated disgust. No good can come to Africa, and no exploration of her rich interior can be carried out with complete success, until this cruel traffic is abolished; and in the interests of science as well as humanity, we hope that the British Government will never cease to use its powerful influence until it is stamped out. We only wish that the Sultan of Zanzibar, whose subjects the half-caste traders nearly all are, could be induced to follow the example of the Khedive of Egypt, and depute some man of determination and vigour to sweep the interior of the entire horde of slave-hunters.

And here we cannot help saying that we almost wish that Livingstone had possessed some of Pasha Baker's wholesome sternness and disregard to the trivial scruples of his men and of petty village chiefs. It would have saved him many annoyances, and might in the end have been the means of saving his life. But he was so full of the great object of his mission that he did not care to waste the time and energy required to bring his low-minded sepoys and Johanna men under discipline; and his conscience was so tender, his humanity so strong, and his desire to live at peace with all men so much of a religion, that he would rather stay weeks at a village to suit the caprice of its childish chief than break away at the risk of giving offence or provoking hostility. His genuine tenderness of heart peeps out unconsciously every now and then, his charity was wonderfully wide, and his forbearance often almost annoying.

Lake Nyassa was reached on August 8, and passing down its east and round its south side, Livingstone struck out in a generally N.N.W. direction for the south end of Lake Tanganyika. We need scarcely say that this part of the journal, recording a journey through a country much of which had not hitherto been explored, is full of valuable notes on geology, botany, zoology, geography, topography, and the manners and customs and connections of the people. Here, as in almost every other part of his journey, the number of streams met with flowing into the great lines of drainage is astonishing; a dozen would sometimes have to be crossed in a day's march. After rounding the south end of Nyassa, however, he first met with those bogs, or earthen sponges, which abound also around Lake Bangweolo, and in the midst of which, and no doubt partly through their malarious influence, he died.

"The bogs, or earthen sponges, of the country," he says, "occupy a most important part in its physical geography, and probably explain the annual inundation of the rivers. Wherever a plain sloping towards a narrow opening in hills or higher grounds exists, there we have the conditions requisite for the formation of an African sponge. The vegetation not being of a healthy and peat-

forming kind, falls down, rots, and then forms thick dark loam. In many cases a mass of this loam, two or three feet thick, rests on a bed of pure river-sand, which is revealed by crabs and other aquatic animals bringing it to the surface. At present, in the dry season, the black loam cracked in all directions, and the cracks are often as much as three inches wide, and very deep. The whole surface has now fallen down, and rests on the sand; but when the rains come, the first supply is nearly all absorbed in the sand. The black loam forms soft slush, and floats on the sand. The narrow opening prevents it from moving off in a landslip, but an oozing spring rises at that spot. All the pools in the lower portion of this spring-course are filled by the first rains, which happen south of the equator, when the sun goes vertically over any spot. The second, or greater rains, happen in his course north again, when, all the bogs and river-courses being wet, the supply runs off, and forms the inundation: this was certainly the case as observed on the Zambesi and Shiré, and, taking the different times for the sun's passage north of the equator, it explains the inundation of the Nile."

This is an important observation with regard to the Nile, though it may very well turn out that Livingstone himself was mistaken with regard to its source or sources. He found, as we have said, the same phenomenon in a much higher degree on the east and south sides of Lake Bangweolo, and believed it to be "the Nile, apparently enacting its inundations, even at its sources."

We wish we could linger with the traveller and speak in detail of some of the multitude of interesting observations he made as he sauntered along. The people themselves between Nyassa and Tanganyika are full of interest to the ethnologist, the sociologist, and the student of the ways of men. Their physique and intelligence are of a high order, and they have scarcely any of the negro characteristics. They are by no means savages, and in almost every village Livingstone was well and kindly treated by the chief and his people. There is no such thing as a national bond of union here, each village being a separate community, presided over by its chief. The region here, as everywhere else in Livingstone's journey, is thickly populated. The people are polite, industrious, and on the whole peaceful, the great disturbers of their peace being the Mazitu, a people to the north of Nyassa, who rove far and wide in search of slaves, leaving death and desolation in their track. The great industry here, and over a great part of the region visited by Livingstone, is the smelting and manufacture of iron, which is obtained in abundance from various ores. In this industry the people display considerable skill and ingenuity, and manufacture the metal into a great variety of implements, utensils, and weapons. Each tribe has its separate tattoo badge. The country itself, hilly, and well wooded, is of the most fertile kind, and abounds in buffaloes, elands, haartebeest, and other large animals, and evidently with not a few birds that are new to the zoologist.

(To be continued.)

INDIAN METEOROLOGY

Report of the Meteorological Reporter to the Government of Bengal for 1873. By Henry F. Blanford, Meteorological Reporter.

MR. HENRY F. BLANFORD'S annual Meteorological Reports for Bengal, of which this is the seventh, have come to be looked forward to with much

interest by meteorologists, as not only model monographs of the subject discussed by them, but as further developing and occasionally opening up certain lines of inquiry which lead to practical applications of the science. In these respects the Report for 1873 is the best, as well as the most suggestive. Its outstanding feature is the discussion of the deficient rainfall of the Presidency during 1873, so disastrous by the famine which followed it; and the developing in the course of the discussion of a principle which, if confirmed by future observations, "will enable us to some extent to forecast our [Indian] seasons, or at least to speak with some confidence to their probable character for some months in advance."

From the increased number of stations now in connection with the department, and from the additional data obtained from the meteorological superintendents of the Governments of Ceylon, the Upper Provinces, Central India, and Berar, it is possible to form a conception of the geographical distribution of pressure, temperature, rain, &c., over one-half of India and its seas. The summaries of all the observations made over the region during the past seven years form an admirable feature of the Report. We very cordially join in the hope expressed that the observations which have been made in the Presidencies of Bombay and Madras will in future be accessible, and that those made in the Punjab will be put on such a footing as to be trustworthy and comparable. As regards the last-named region, in all the annual reports we have seen (down to 1870) the barometric observations are given uncorrected for temperature and unaccompanied with the readings of the attached thermometer! When, on making the annual survey of the meteorology of India, the north-west, west, and south of the country can be included, it will be possible to write the history of the two monsoons of the year, and probably to point out the determining causes of their irregularities.

"The principal meteorological characteristics of the year 1873 were an excessive temperature, in Oude and the North-western Provinces more especially; an unusually low pressure of the atmosphere in the same region, and probably also in the south-east corner of the Bay of Bengal, while in Eastern Bengal pressure was persistently high; great unsteadiness in the winds, indicating the predominance of local causes in affecting the air currents, while the normal monsoon current from the south-west set in nearly a month later than usual, and ceased nearly a month earlier; lastly, a general deficiency of moisture in the atmosphere, as is betokened both by the hygrometric observations, the comparative absence of cloud, and the great deficiency of rainfall."

The usual characteristics of the Indian summer monsoon, based on the past seven years' observations, are thus stated:—

"In ordinary years the winds of the south-west monsoon blow, on the one hand from the Arabian Sea, on the other hand from the Bay of Bengal *towards a line lying to the south of the Ganges*, at no great distance, and parallel to that river. A barometric depression begins to appear in or near this region in April, and by the time the rains set in in June it is well established; the pressure decreasing along it from east to west where this trough, as it may be termed, merges in the great barometric depression of the Punjab and the Bikaner Desert. To the south of this line the winds from the Arabian Sea blow across the Central Provinces, chiefly from the west. To the north of it, those from the Bay of Bengal, turning

with the Gangetic Valley, blow in an opposite, or easterly, direction, their line of meeting being along this trough."

Bengal being thus dependent, as regards its rainfall, on the aerial current which blows from the Bay of Bengal up the valley of the Ganges, it is evident that whatever weakens this current or directs it to the northward will have a serious influence on the rainfall. Now, in 1873 the trough described above did not occupy the usual position to the south of the Ganges, but a position considerably to the north-west, in Oude and Rohilkund, immediately under the hills. A change in the direction of the wind necessarily followed this change in the position of the area of lowest atmospheric pressure; and in strict accordance with the now well-known relation of wind to pressure, there was an unusual prevalence of westerly winds over the greater part of Bengal during June and July, and the rainfall consequently was deficient.

The observations made in the Andaman and Nicobar Islands show the existence of a barometric depression over the south-eastern portion of the Bay of Bengal, the effect of which would be to deflect a large portion of the monsoon current of the Bay of Bengal towards Sumatra and the Tenasserim and Burmah coasts. Thus, then, the monsoon current, on which Bengal is dependent for its rainfall, was not only deflected northward from its usual track during 1873, but was also weakened in force by being partially drained away to the south-east in the direction of Burmah.

In the examination of the rainy seasons of 1868, 1869, and 1873, Mr. Blanford has the merit of first drawing attention to the existence of local and persistent variations of pressure, which appear as a local exaggeration or partial suppression of the great annual variation—the pressure remaining for many months, sometimes through two or more consecutive seasons, either higher or lower than the average, relatively to other parts of the country, over a more or less extensive track. It is to these persistent irregularities in the distribution of atmospheric pressure that the irregularities in the distribution of the rainfall must be ascribed, and it is to the further investigation, by future observations, of the characteristic feature of persistency in this class of barometric variations that we look with hope to the realisation of a great triumph awaiting meteorology, viz., the prediction, for some months in advance, of the general character of the coming seasons of India, and thereafter a gradual extension of the principle to other countries.

As regards the humidity, the only data of observation published in the Report are the dry-bulb observations. To these are added the *computed* values for the elastic force of vapour and the relative humidity. In future issues of the Reports we should recommend that the wet-bulb observations be also published. In a country of such extreme climates as India, it is eminently desirable to have the whole *observed facts* relative to the humidity before us, particularly since, from the present defective state of our hygrometric tables as regards dry hot climates, computed values can be regarded only as rough approximations. In estimating the state of the sky, a clear sky is entered as 10, and a sky completely covered with cloud as 0. It might be well in future to adopt the recommendation of the Vienna Meteorological Congress on this head, by which a clear sky is

entered as 0, and a sky completely covered with cloud as 10. The number of days at the various stations at which "a measurable quantity of rain fell," are given in Table xxx. The exact amount of rain constituting a rainy day should in future be stated. In Great Britain only those days on which at least 0·01 inch falls are regarded as "rainy days." We are glad to see that Symons' gauges (5-in. diam.) are adopted—this being the gauge best suited for general introduction—and that the height is a foot above the ground.

We have long been convinced that for a first satisfactory scientific discussion of some of the more difficult problems of the science we must look for the data of observation to India, with its splendid variety of climates, exposures, and abrupt mountain ranges and isolated peaks. The chief of these questions are, the variations in the daily march of temperature as dependent on season, latitude, height, and situation, both maritime and inland; the hourly barometric fluctuations (of which so little is really known), particularly as influenced by strong insolation, vapour, cloud, aqueous precipitation, and height either on extended plateaus or on hills rising abruptly from the plains; and the vital question of atmospheric humidity, to put which on a proper footing as regards hot dry climates, laboratory experiments being all but worthless, recourse must be had to extensive observations and experiments conducted under such conditions as are presented by the scorching climate of the Punjab. In the further development of Indian and general meteorology, the establishment of a Physical Observatory in the Punjab is urgently called for, as being, in truth, indispensable for the prosecution of these and other physical researches.

OUR BOOK SHELF

A Year's Botany, adapted to Home and School Use. By Frances Anna Kitchener. Illustrated by the Author. (Rivingtons: London, Oxford, and Cambridge, 1874.)

THIS unpretending little book is one that is sure to find its way wherever Natural Science is taught in the only way in which it is worth teaching, as a training for both the observing powers and the reasoning faculties. The greater part appeared originally in the *Monthly Packet*, and has been reprinted with additions at the request of friends more discriminating than is usually the case under such circumstances. We know of no book which we could more safely and confidently place in the hands of young people as their first guide to a knowledge of botany. The illustrations are from drawings from nature by the authoress, and are a pleasing change from those which have already done duty in so many text-books.

The following sentence, from the first chapter, illustrates the mode in which the writer conveys her instruction:—"But first I must beg that my readers will give me a fair trial; that they will pick the flowers described, and examine them *while* they read the description; and that they will trace every law, arrangement, and peculiarity in their living illustrations. Sometimes these may not be seen at the first glance, or even in the first specimen, but they must pick fresh flowers, look and look again, and *take nothing upon trust*, remembering that one of the chief lessons botany has to teach is how to use both eye and hand." Several typical flowers are then taken—the buttercup, wall-flower, cucumber or vegetable marrow, gorse, garden-pea, and primrose, and the various parts of each described in ordinary language, without the use of any technical terms. To these succeed separate chapters

"On Flowers with Simple Pistils," "On Flowers with Compound Pistils," "On Flowers with Apocarpous Fruits," "On Flowers with Syncarpous Fruits," and "On Stamens and the Morphology of Branches." To each chapter is prefixed a list of specimens which will be required to enable the student to follow for himself the writer's analysis; the descriptions are given in an extremely easy and lucid style, a few of the commonest scientific terms—but as few as possible—being gradually substituted for the colloquial English phrases at first employed. A sufficient acquaintance having then been obtained with the morphology of the more conspicuous organs, and their functions at the same time explained, the phenomena of nutrition, respiration, and fertilisation, and the structure of tissues, are described in chapters "On Fertilisation," "On Seeds," "On Early Growth and Food of Plants," "On Wood, Stems, and Roots," and "On Leaves." A chapter is then given to classification, to which is appended some useful tables of the characters of the more important orders; and this is followed by two or three chapters devoted to a few of the more important natural orders, and intended to serve as an introduction to the mode of naming plants. The most commonly used technical terms which have not been employed in the work itself are explained in an appendix, in which the wants of students preparing for the University Local Examinations have been kept in view.

The mistaken plan on which many botanical text-books have been compiled is so largely answerable for the horror in which the subject is held by candidates for examination who endeavour to cram facts and technical terms in an incredibly short space of time, without an attempt at practical work, and in the end fail miserably, that we cordially welcome an attempt to place the study on its true footing. We entirely concur in the view of the writer, that to this false method is due the fact that "Botany is so often stigmatised as a dry, uninteresting study;" an opinion which would speedily disappear were her mode of instruction in general use in the family and the school. Mrs. Kitchener's "A Year's Botany" seems to us admirably adapted for the purpose which she had in view in publishing it, and we heartily desire for it a large circulation.

A. W. B.

Dental Pathology and Surgery. By S. J. A. Salter, F.R.S. (London: Longmans, Green, and Co., 1874.)

THERE is much in dental surgery besides the simple extraction of teeth, and it is to the consideration of the science of dental pathology that Mr. Salter devotes most of the work under notice. The introductory chapters treat shortly of structure and function, development being left out of consideration. An excellent diagram explains the relation of the tongue to the different parts of the mouth during the pronunciation of the various letters of the alphabet, which latter is arranged on a physiological basis, dependent on the situation of the point of closure by which the sound is produced, upon the completeness or incompleteness of the closure, and upon whether the breathing is soft or aspirate. To the purely physiological student the chapter on irregularities in the position and union of contiguous teeth will be of particular interest; as will the instances given of defects in their number depending on hereditary causes, and on alopecia; to which we may add the peculiar deficiency always connected with the excessive development of hair over the face, as in the Russian man and child who so recently visited this country. The differentiation off from pure surgery of a class of tumours which, before Mr. Salter's investigations, were considered to belong to the bones themselves, and which, as odontomes, are now known to be composed of secondary dentine, will be specially instructive to the pathologist, as will the question of reflex nervous phenomena, such as partial paralysis and blindness, from the irritation of a diseased tooth. A full and very instructive account is also given of "phosphorus